# MITIGATION OF UNSTEADY PEAK FAN BLADE AND DISC STRESSES IN TURBOFAN ENGINES THROUGH THE USE OF FLOW CONTROL DEVICES TO STABILIZE BOUNDARY LAYER CHARACTERISTICS

## Abstract

Method and apparatus for providing a turbofan blade 40 adapted to initiate and control a boundary layer transition at a side surface of the blade 40 during operation as a component in a turbofan assembly 35. The turbofan blade 40 includes a leading edge 55, a trailing edge 58, and two side surfaces including a high-pressure side surface 49 and a low-pressure side surface 52. At least one of the two side surfaces has an essentially smooth surface portion 61 located between the leading and trailing edges, and the essentially smooth surface portion is interrupted by a surface deviation 64. The surface deviation is configured to fix a positionally unstable laminar to turbulent boundary layer transition 24 at a location toward the trailing edge from the surface deviation during operation of the turbofan blade in the turbofan assembly. In this manner, fatigue inducing and/or structurally damaging unsteady aerodynamic forces experienced upon the blade and/or fan disc during operation are controlled, and the resultant fluctuating fan blade and disc peak stresses are mitigated.